PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference WO 21.1065	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/EP 03/13147	International filing date *(day/month/year)* 21.11.2003	Priority date *(day/month/year)* 31.12.2002
International Patent Classification (IPC) or both national classification and IPC G01V5/04		
Applicant SERVICES PETROLIERS SCHLUMBERGER et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
29.07.2004	08.04.2005
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Juárez Colera, M Telephone No. +49 89 2399-2482

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP 03/13147

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-16 as originally filed

Claims, Numbers

1-11 received on 17.03.2005 with letter of 17.03.2005

Drawings, Sheets

1/9-9/9 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-11
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-11
Industrial applicability (IA)	Yes:	Claims	1-11
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Important clarity objections (Article 6 PCT)

1.1 From the wording of claims 1 and 6 it is not clear whether the step of performing spectral stripping is performed downhole or at the surface and where the corresponding processor is situated.

1.2 As it is formulated, claim 1 does not specify that all the raw spectroscopy data processing is performed downhole and therefore, it leaves open the possibility of the spectral stripping being executed both downhole and at the surface.

1.3 Similarly, claim 6 does not clarify whether the feature that the means for performing the spectral stripping are downhole means or surface means.

2 Prior art

Reference is made to the following documents:

D1: US-A-5 539 225
D2: US2002153888
D3: WO9817894

The documents D2 and D3 were not cited in the international search report. Copies of the documents are appended hereto.

3 Article 33 (1) and (2) PCT (Novelty)

3.1 None of the available prior art documents discloses an acoustic logging apparatus with the combination of features described in claims 1 and 6. The subject matter of these claims is therefore new.

3.2 Claims 2-5 and 7-11 are dependent on claims 1 and 6 respectively and as such also

meet the requirements of the PCT with respect to novelty.

4 Objections under article 33 (1) and (3) PCT (Inventive Step)

4.1 The above-mentioned lack of clarity notwithstanding, the subject-matter of claims 1-11 does not involve an inventive step in the sense of Article 33(3) PCT, and therefore the criteria of Article 33(1) PCT are not met. The reasons are as follows.

4.2 The document D1 discloses (abstract; c.6, l. 14-22; c. 8, l. 54-59; c. 9, l. 1-19; c. 16, l.7-11, c.18, l. 16-19 and Fig.1): a method and apparatus for downhole spectroscopy processing comprising the steps of- and the corresponding means for obtaining raw spectroscopy data, processing them downhole and transmitting the obtained downhole processed solution to a surface processing system to determine lithology information.

4.3 The subject-matter of claims 1 and 6 therefore differs from that of D1 in that it includes the feature of part of the data processing, i.e. obtaining a net capture spectra and performing spectral stripping, being performed downhole.

4.4 The problem to be solved by the present invention may therefore be regarded as decreasing data volume to be sent to the surface.

4.5 Including downhole means to perform part of the data processing is considered as widely know in the art and moreover has already been employed for the same purpose, i.e. for determination of lithology, and for solving the same problem, in similar tools, see, e.g. documents D2 (abstract and p.2, col.1, l. 59-63) and D3 (p.61, l. 1-3). It would be obvious to the person skilled in the art, namely when the same result is to be achieved, to apply this feature with corresponding effect to a tool according to document D1, thereby arriving at a method and apparatus according to claims 1 and 6.

4.6 Dependent claims 2-5 and 7-11 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step.

4.7 The additional features introduced by those claims constitute part of the normal processing techniques known by the persons skilled in the art. They are therefore considered as merely some of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill.

4.8 Consequently the present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of the above-mentioned claims does not involve an inventive step in the sense of Article 33(3) PCT.

5 Article 33 (1) and (4) PCT (Industrial Applicability)

The subject matter of claims 1-11 is susceptible of industrial application.

Claims

[c1] A method for downhole spectroscopy processing comprising:

obtaining raw spectroscopy data using a downhole tool;

processing the raw spectroscopy data using the downhole tool to obtain a downhole processed solution;

transmitting the downhole processed solution to a surface processing system; and

using the surface processing system to determine lithology information from the downhole processed solution.

[c2] The method of claim 1, wherein processing comprises time-stacking the raw spectroscopy data.

[c3] The method of claim 1 or claim 2, further comprising comparing the downhole processed solution with data obtained from another downhole tool.

[c4] The method of any of claims 1-3, further comprising displaying the lithology information on a user interface.

[c5] The method of any of claims 1-4, wherein processing the raw spectroscopy data comprises:

pre-processing the raw spectroscopy data to obtain a net capture spectra; and

performing spectral stripping using time information and the net capture spectra to determine elemental yields.

[c6] The method of claim 5, wherein processing the raw spectroscopy data further comprises:

determining dry weight elemental concentrations using the elemental yields;

determining a dry weight for at least one selected from the group consisting of clay, carbonate, quartz-feldspar-mica, pyrite, anhydride, siderite, salt, and coal using the dry weight elemental concentrations; and

computing a matrix property using the dry weight elemental concentrations.

[c7] A downhole tool for processing raw spectroscopy data, comprising:

at least one detector for detecting the raw spectroscopy data;

processing means for processing the raw spectroscopy data to produce a downhole processed solution; and

means for transmitting the downhole processed solution to a surface location.

[c8] The downhole tool of claim 7, wherein the processing means comprises means for determining elemental yields.

[c9] The downhole tool of claim 7 or claim 8, wherein the processing means comprises means for computing a matrix property.

[c10] The downhole tool of any of claims 7-9, wherein the processing means comprises:

means for pre-processing the raw spectral data to obtain a net capture spectra;

means for performing spectral stripping using time information and the net capture spectra to determine elemental yields; and

means for determining dry weight elemental concentrations using the elemental yields.

[c11] The downhole tool of claim 10, wherein the processing means further comprises:

means for determining a dry weight for at least one selected from the group consisting of clay, carbonate, quartz-feldspar-mica, pyrite, anhydride, siderite, salt, and coal using the dry weight elemental concentrations; and

means for computing a matrix property using the dry weight.

[c12] The downhole tool of any of claims 7-11, wherein the processing means comprises:

a digital signal processor (516);

a power supply (520) operatively connected to the digital signal processor (516);

a local memory (518) operatively connected to the digital signal processor (516); and

a processing interface (514) operatively connected to the digital signal processor (516).

[c13] A real-time lithology measurement system, comprising:

a surface processor; and

a downhole tool for processing raw spectroscopy data, the downhole tool comprising:

at least one detector for detecting the raw spectroscopy data;

processing means for processing the raw spectroscopy data to produce a downhole processed solution;

means for transmitting the downhole processed solution to the surface processor;

wherein the surface processor comprises means for determining lithology information from the downhole processed solution.

[c14] The system of claim 13, further comprising a user interface; wherein the lithology information is displayed on the user interface.

[c15] The system of claim 13 or 14, wherein the processing means comprises means for determining elemental yields.

[c16] The system of any of claims 13-15, wherein the processing means comprises means for computing a matrix property.

[c17] The system of any of claims 13-16, wherein the processing means comprises:

means for pre-processing the raw spectral data to obtain a net capture spectra;

means for performing spectral stripping using time information and the net capture spectra to determine elemental yields; and

means for determining dry weight elemental concentrations using the elemental yields.

[c18] The system of claim 17, wherein the processing means further comprises:

means for determining a dry weight for at least one selected from the group consisting of clay, carbonate, quartz-feldspar-mica, pyrite, anhydride, siderite, salt, and coal using the dry weight elemental concentrations; and

means for computing a matrix property using the dry weight.

[c19] The system of any of claims 13-18, wherein the processing means comprises:

a digital signal processor (516);

a power supply (520) operatively connected to the digital signal processor (516);

a local memory (518) operatively connected to the digital signal processor (516); and

a processing interface (514) operatively connected to the digital signal processor (516).

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 03/13147

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01V5/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01V

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 539 225 A (HOLENKA JACQUES M ET AL) 23 July 1996 (1996-07-23) column 3, line 48 - line 54 column 6, line 14 - line 22 claim 22 column 16, line 7 - line 11 column 8, line 54 - line 59 column 9, line 1 - line 18	1,2,4,5, 7-9, 12-14,19
A	column 14, line 8 - line 13	6,10,11, 15-18

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 April 2004	20/04/2004

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Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 03/13147

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DATABASE WPI Section Ch, Week 197515 Derwent Publications Ltd., London, GB; Class H01, AN 1975-25362W XP002246184 & SU 407 258 A (TATNEFTEGEOFIZIKA TRUST) 23 July 1974 (1974-07-23) abstract	3

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ERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 03/13147

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5539225 A	23-07-1996	AU 689326 B2	26-03-1998
		AU 3628795 A	29-03-1996
		BR 9508924 A	28-10-1997
		CA 2199726 A1	21-03-1996
		CN 1177402 A ,B	25-03-1998
		DE 69516525 D1	31-05-2000
		EP 0781422 A1	02-07-1997
		JP 11511845 T	12-10-1999
		NO 971202 A	16-05-1997
		WO 9608733 A1	21-03-1996
		US 5608215 A	04-03-1997
		US RE36012 E	29-12-1998
		US 5804820 A	08-09-1998
SU 407258 A	21-11-1973	SU 407258 A1	21-11-1973